

WHAT IS CLAIMED IS:

- 1 1. A body fluid sampling device comprising:
2 a single cartridge;
3 a penetrating member coupled to said single cartridge; and
4 an analyte detecting members.
- 1 2. A method of controlling fluid flow, the method comprising:
2 (a) providing a cartridge configured to slidably hold a plurality of
3 penetrating members and to have a plurality of analyte detecting members; and
4 (b) using surface texturing on the cartridge to form texturing to direct
5 fluid into a desired area on the cartridge.
- 1 3. The method of claim 2 wherein said texturing is formed
2 chemically.
- 1 4. The method of claim 2 wherein the surface texturing guides the
2 fluid to one of said analyte detecting members.
- 1 5. A body fluid sampling device comprising:
2 a single cartridge;
3 a plurality of penetrating members coupled to said single cartridge and
4 operatively couplable to a penetrating member driver, said penetrating members movable
5 to extend radially outward from the cartridge to penetrate tissue;
6 a plurality of analyte detecting members coupled to said single cartridge,
7 wherein at least one of said analyte detecting members positioned on the cartridge to
8 receive body fluid from a wound in the tissue created by the penetrating member when
9 the cartridge is in an operative position; and
10 a texture structure on said cartridge positioned to guide fluid generated by
11 said tissue towards one of the analyte detecting members.
- 1 6. A body fluid sampling device comprising:
2 a single cartridge;

3 a plurality of penetrating members coupled to said single cartridge and
4 operatively couplable to the penetrating member driver, said penetrating members
5 movable to extend radially outward from the cartridge to penetrate tissue;
6 a plurality of analyte detecting members coupled to said single cartridge,
7 wherein at least one of said analyte detecting members positioned on the cartridge to
8 receive body fluid from a wound in the tissue created by the penetrating member when
9 the cartridge is in an operative position; and
10 a plurality of mesh structures positioned to draw fluid generated by said
11 tissue towards one of the analyte detecting members.

1 7. The device of claim 6 further comprising a ring around the
2 cartridge wherein said analyte detecting members are mounted on said ring, along with
3 said mesh.

1 8. The device of claim 6 further comprising a ring around the
2 cartridge wherein said analyte detecting members are coupled to said cartridge through
3 said ring.

1 9. The device of claim 6 further comprising a plurality of electrodes
2 coupled to said analyte detecting member.

1 10. The device of claim 6 wherein the mesh is a gradient mesh.

1 11. A body fluid sampling device comprising:
2 a support structure;
3 a sensory material on a first side of said support structure;
4 a conductor material coupled to the sensory material; and
5 a commutator positioned to engage said conductor material to obtain
6 analyte measurements.

1 12. The device of claim 11 further comprising a radial cartridge, said
2 support structure coupled to said radial cartridge.

1 13. The device of claim 11 further comprising a plurality of electrodes
2 each having said sensory material.

1 14. A penetrating member actuator comprising:

2 a support structure;
3 a first electrode;
4 a second electrode;
5 an elastomeric material between said electrodes, wherein said material
6 elongates upon activation of the electrodes, causing a penetrating member to move.

1 15. The device of claim 14 further comprising a radial cartridge, said
2 material having a gripper positioned to engage penetrating members on said radial
3 cartridge.

1 16. The device of claim 14 further comprising a coupler in contact with
2 the material for coupling the penetrating member to the material.

1 17. A method for designing an analyte detecting member, the method
2 comprising:

- 3 (a) mathematically replicating the significant physical and chemical
4 processes taking place in the analyte detecting member and sample; and
5 (b) dividing assay time into small time steps and the analyte detecting
6 member into small control volumes, wherein during each time step (and in each control
7 volume), the model simultaneously solves a specie conservation equation for each
8 important constituent: oxygen, glucose, glucose oxidase, catalase, and hydrogen peroxide.

1 18. The method of claim 17 wherein each conservation equation
2 includes an accumulation term, a diffusion term, and a production/destruction term
3 wherein the latter relies on a production rate calculated either as a Michaelis-Menton
4 reaction (catalase) or Ping-Pong Bi-Bi reaction (glucose oxidase).

1 19. The method of claim 17 wherein tracking the diffusion of each
2 important chemical component of the emulsion and sample, the chemical reactions
3 between them, and the resulting signal from oxygen depletion.

1 20. The method of claim 17 wherein treating the emulsion as a
2 continuum with properties based on volume-fraction averages of the properties of the
3 hydrophobic and hydrophilic phases.

1